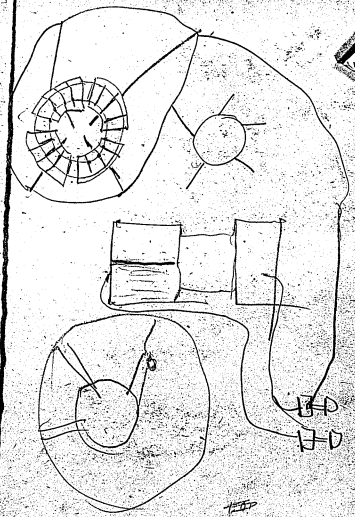
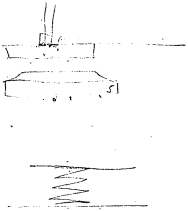
Notebook, N-89-08-30

This notebook covers the period August 1889-April 1890. At the beginning of the book are notes and drawings by Charles Batchelor regarding electric brakes and electric railways. There are also notes by an unidentified experimenter on the use of the "Edison meter," meter readings for Glenmont and three other homes in Llewellyn Park for March and April 1890, and notes by Arthur E. Kennelly regarding electrical experiments. At the other end of the book are additional drawings by Batchelor on the electric railway, along with calculations by Kennelly concerning electric power distribution at Ochre Point in Newport, Rhode Island. In addition, there are notes regarding a series of electro-cautery experiments. The pages are unnumbered, and the book has been used in both directions. Several pages have been removed from the book. Approximately 120 pages have been used.

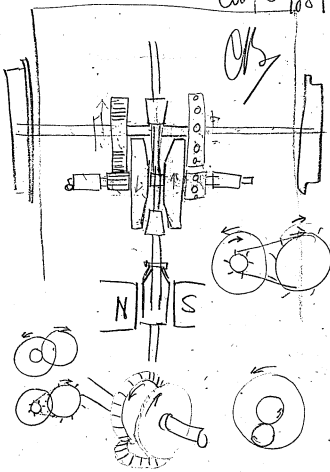
(*E-172)

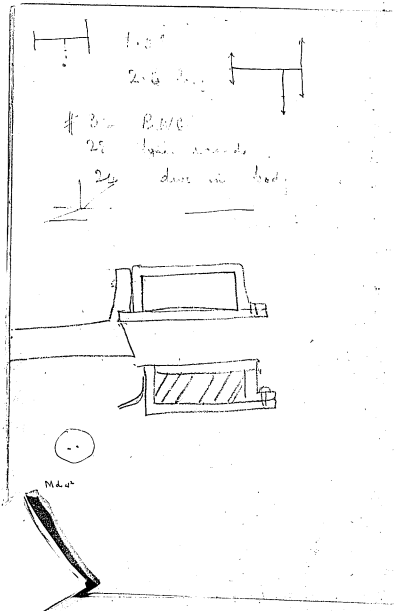
N-89-08-30





Aug 30 1889





Dec 27 1889

Test of Car motor

20½ V on fields

85 Rev. per minutes

1·1 Volts at Arm terminals

Transformer was running with 100 Volts on primary

3·1 Volts at terminals

288 Revol.

20·6 Volts on field

Transformer Alt. 200 Volts

When field charged with 44 Volts speed was 220.

House service mains.

section

80	100	120	150	200	250
445	270	320	1305	725	
530	470	830		675	
505	475	475		1400	
770	300	1625			
475	350				
1225	240				
125	175				
150	2240				
270					
605					
5,390					
2270					
1625					
1305					
1400					
11950					

directions for using the Edison Meter.

Clean the plates thoroughly with a file, taking care not to handle the zinc with the fingers.

Amalgamate them thoroughly by dipping for a moment into dilute sulphuric acid (about one part acid and 15 water) and then in mercury, the superfluous mercury must be removed, and the plate must present a clean and silvery appearance.

Varnish the copper side just a little above the zinc, to prevent the formation of sulphate of copper in the solution.

Carefully dry the plates in warm dry place.

Weigh them carefully [illegible], after which weight the couples together, as a check on the single weights.

In fastening them, be particular not to touch the zinc with the fingers as the grease will prevent the deposit

on that place, ~~before allowing so much extra surface, as well as increasing the weight.~~

Place in bottles and fill with solution about one eighth of an inch above top of plates, cork up thoroughly and distribute.

The ends of the rods should be lightened with a piece of every bottle, also the inside of the clamps of the meters.

The old meters should be taken out of the cells and immediately washed off gently in a jar of water, to remove all surplus of zinc solution, which would otherwise crystallize and increase the weight, producing an error in the meter system.

Dry thoroughly and weigh carefully, ~~weighing as before to check the zinc weight.~~

The amount of current that passes through a meter is $\frac{1}{975}$ part of the whole current.

The fractional part of the entire current which passes through the bottles remains for one plate and deposits on the other an amount of zinc equivalent to 1.224 milligrams per ampere hour of current.

The mean of the gain and loss of the anode plates of their cell.

The bill can then be made out [illegible]

Directions for using the Edison Meters

Clean the plates thoroughly with a file, taking care not to handle the zinc with the fingers.

Amalgamates thoroughly by dipping them for a moment into dilute sulphuric acid (about one part acid to 15 parts water), and then in mercury; the superfluous mercury must be removed, and the plates must present a clean and silvery appearance.

The ends of the copper rods must be cleaned with a piece of emery cloth, also the inside of the clamps of the meters.

Varnish the copper rods just a little above the zinc, to prevent the formation of copper sulphate in the solution.

Carefully dry the plates in a warm dry place, after which they must be carefully weighed. In fastening them together, be particular not to touch the zinc with the fingers, as the grease will prevent the deposit on that place.

Place in bottles, and fill with solution to about 1/8 of an inch above top of zinc, cork up thoroughly and distribute.

The returned plates should be taken out of bottles, and immediately washed off gently in a jar of water, to remove all sulphate of zinc crystals, which would otherwise crystalize and increase the weight, producing an error in the meter system.

Dry thoroughly and weigh carefully.

The amount of current that passes through the meter is $\frac{1}{775}$ part of the whole current.

The fractional part of the entire current which passes through the bottles removes from one plate and deposits on the other an amount of zinc equivalent to 1.224 milligrams per ampere hour of current.

The mean of the gain and loss of the couple is divided by 1.224 and that gives the ampere hours of that cell.

The bill can then be made out.

Numerator of Oxidized iron ore
ring
Weight in air, 2 lbs 11 3/4 ozs.
Weight " " with tape 2 lbs 12 ozs.

[illegible] at [illegible] terminus
with [illegible] [illegible] 5.1

13½ [illegible] per minute

[illegible] with [illegible] volume
at [illegible]

[illegible] 17 revs per min

[illegible] at [illegible] 1 amp

[illegible]
15½ [illegible] per minute

4Y
54 13/8

15 1/2
9 1/8
11 3/4
12
8 3/8
54 3/4

19 1/2
28 1/4

5 7/8
11 3/4
7 3/4
19 1/2

On one dead

" "

Meteoplates for March 1890.

1	80.989	81.366 161.493
2	80.436	80.127
3	78.526	77.802, 156.072
4	77.456	78.270
5	78.703	78.224, 156.187
6	79.476	79.963,
7	72.965	72.764, 149.942
8	76.971	77.179
9	72.690	73.162 146.343
10	75.666	75.186
11	78.854	78.983 157.085
12	78.235	78.103
13	75.098	76.188, 147.473
14	72.329	71.357
15	80.030	81.062, 158.926
16	78.867	77.909
17	79.892	80.913, 158.797
18	78.764	77.887
19	76.990	77.741, 159.457
20	82.380	81.716

27 X 2.52 6858

14.800

27" 87.925

100' line upper upper cross hair cross hair

62.011 57.296 57.296

88.052

62.011 62.008

57.296 57.296

4.715 4.715

14.802

73.250

4.715

68.535 14.803

4 divs of level produce 0.006 error at the distance of 35"

1 div 0.0015

373

273

19

290

74.82 : x :: 290 : 373

75X373

94

290) 26000 (90

90

46.8

15.2

390 : 290 :: 75

390 X 75

290

39000

6750

29250 = 100

25

16. 90

Lands Res.

Green + red 0·328 w 0·037 = 0·365
red + yellow 0·343 + 0·028 = 0·371
green + yellow 0·326 + 0·037 = 0·363

Bar: 74·82 Therm Bar. 67°F
17·2 C Std # 1

20 o'clock
g + y 10·265 w 9·839 T 9·763 20·5°C
g + r 10·250 9·922 9·836
r y 20·170 19·827 19·7 Temp Hg 15·4°C

Chronometer @ zero 11·926

20·12 Current on clock 1·8 amp 16·638
20·25 10·990 g r 11·15 g + y.
10·9662 10·824
20·30 C. 20·594 y g 11·62 y r 23·18 w
11·294 ·837
20·40 23·946 r + y 23·988
23·937
g r 12·28 12·28 g + y
12·932 11·954
20·58 28·970 r + y 25·467
25·467
g r 12·96 12·97 g + y
12·1632 12·1644
TB 21·00
21·13 31·650 r + y 26·50 26·157
g r 13·49 13·485 g + y
13·162 13·159

~~31·806~~

21 × 252
5334

0·0131 ÷ 30
·00043 × 9 = ·00387
·0077

0·0178
·014

0·0139 0·0239
0·0378

0·0340
0·0440 0·037
·0780
·0370
·041

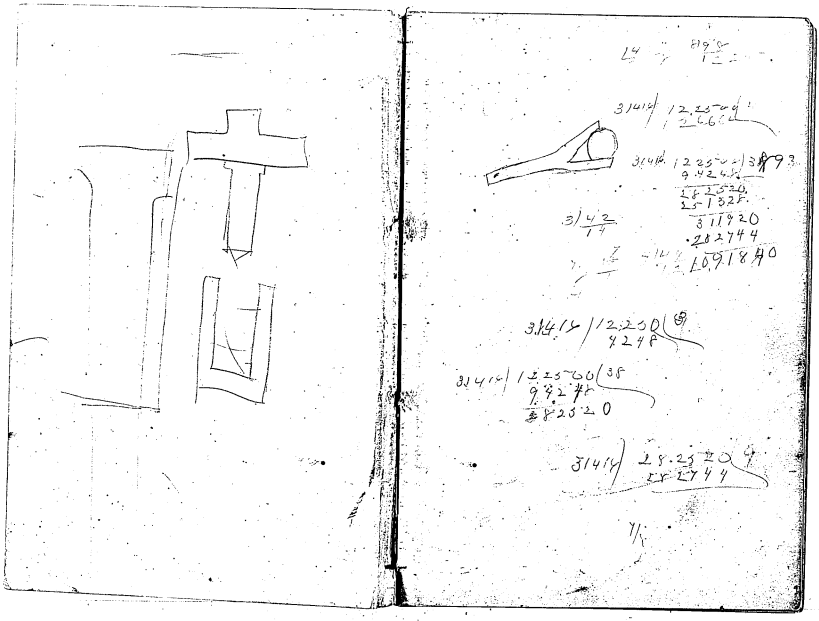
Time	Calls:	g·ry	Res: g+r	g·ry	Temp: Obl	Ob
21.28	34.502	27.555 / 27.207	13.797 / 14.103 / 13.775	13.694 / 14.028 / 13.734	210°F / 250°F	
21.31	37.158	28.330 / 27.957	14.36 / 14.032	14.30 / 13.974	220°F / 250°	
21.60	[illegible]					
.50	36.722	[illegible]				
.55	34.960	[illegible] / 26.707				
22.00	31.436	26.07 / 25.787				
22.06	28.320	25.07 / 24.737				
22.16	25.190	24.02 / 23.677	r·g·	g·ry.		
22.29	21.790	22.97 / 22.627	11.612 / 11.292	11.60 / 11.274	22.51 / 22.227	

T.B. 22.2°C T. Hg 16.6°

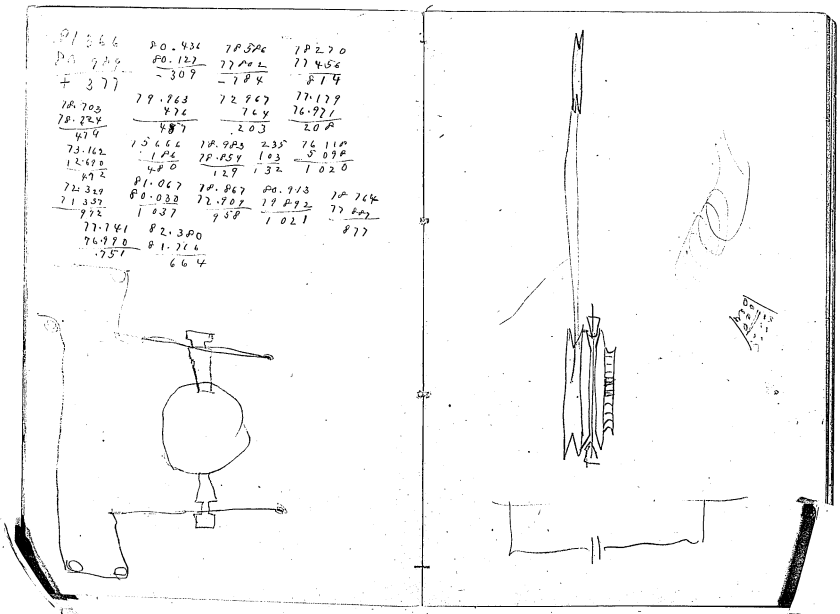
Meter Plates for April. 1903

1	76.526	154.233	Mr Yates
2	77.731		
3	83.612	167.725	
4	84.116		
5	80.922	164.121	Mr Lutkin
6	83.201		
7	84.800	165.544	
8	80.746		
9	81.288	164.683	Mr Turner
10	83.395		
11	81.588	159.763	
12	78.177		
13	80.905	155.371	Mr Ross Clarke
14	74.467		
15	74.714	157.065	
16	82.352		
17	80.951	159.202	
18	78.252		
19	79.123	161.467	
20	82.344		

[THIS BOOK WAS USED IN BOTH DIRECTIONS. THE FOLLOWING PAGES WERE FILMED FROM THE BACK END FORWARD.]



19"



2 686 784 479 411
343 1588 487 206
796 966
472 484
480
992
476

261 1992 2095 1021 1415
131 9.96 1048 877 708
1898
946

1224/131000 (107
1224xx
08600 | 1224996.000 (814
8568 97924
1680
1224
4560
3672
888

343
1.224/343.0000
2 835 2941

Log. of 1.224 = 850 2480
2. 205-0461
204 1200
20 11261

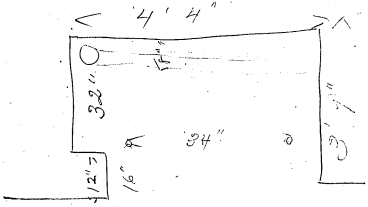
1224/796.0000 (650
734xx
6160
6120
400

1.224/343.0000 (280.2
2448xx
9820
9792

1224/206.000 (168
122xxx
8360
7344
1016
972
368

1224/494.000 (2800
367xxx
11880
11016
6640
6120

1224/4388
367xxx
10880
9792
1088.0



1224/1048000 (856
9792xx
6880
6120
7600
7344

1224/700000 (577
734xx
6120
9400
8568
8320

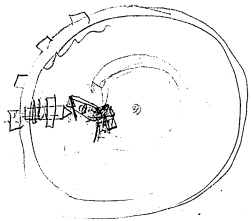
1224/946000 (773
8568xx
8920
8568
3520
3672

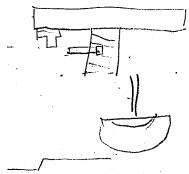
563
2
1126
495
1980

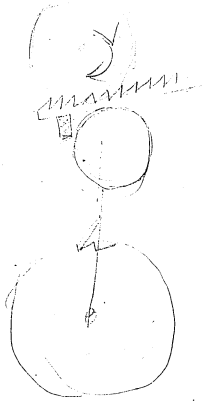
1224
3020
120.80

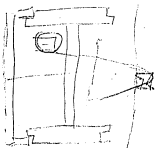
10
10
10
10

120	44
104	365
124	355
98	343
107	157
114	300
95	39
75	187
88	399
98	136
120	400
144	582
161	163
120	347
130	395
111	142
172	485
125	126
161	71
295	270
197	321
141	120
116	120
320	140
162	26
128	143
165	6136
163	
176	
4295	









80.989
80 436
161 425

81366
80 127
161493
161423
6P

78 5P6
72458
156042

77 802
78 220
6072

72965
76971
149936

77264
77179
149943
34

78 703
79 416
158119

78 224
79 763
158187
79

72690
75666
148356

73162
75142
148348

78854
78235
157089

78983
78103
157086

75 098
72 329
147427
658800
158666
144

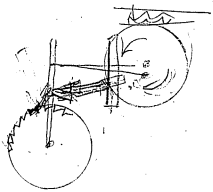
76118
71357
147476
27
48

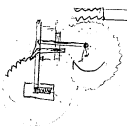
80.030
78 862
158.892

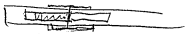
81067
77909
158876
8 887
079

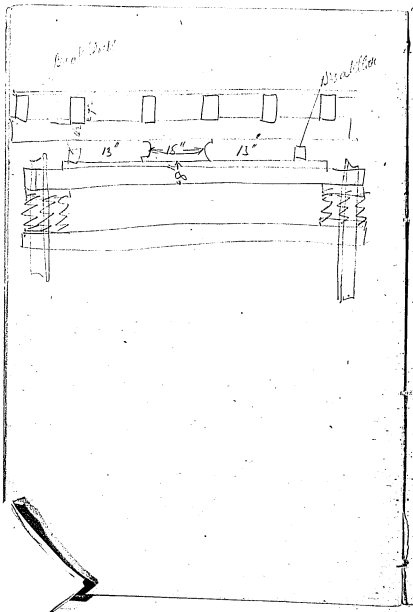
76 990
82 380
159370

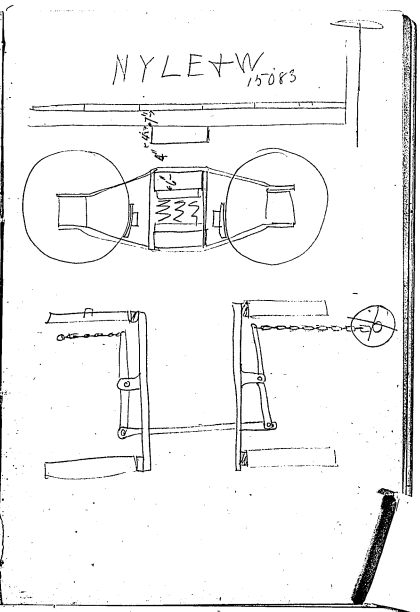
159457
370
87








13"
15"
13"


NYLE+W 15083

16"
12"
10½"
7½"

Get from Burlingham

1 Steel brush for centre rail
2 " " " ordinary rail
3 Contact with axles
4 Brush arrangement for middle rail
5 Drawing for automatic stops

Drill cores for screws & bolts
~~Fix fibre in~~
~~Drill cores for stud & pins~~
3 Wind cores
4 Plane motor brackets & drill
5 Bore field for motor
6 Drill channel iron for motor
7 Plane slides for reversing brackets
8 Turn friction rolls
~~9 Drill oil hole in cores~~
~~10 Drill dowel pins in cores~~
~~11 Turn friction washers for worms~~
~~12 Keyways in reversing screws~~
~~& filling keys~~
13 Making reversing lever rigging
14 Making automatic stop
~~15 Planing & drilling brackets for~~
~~[illegible]~~

Making Intermediate Gear Stud

~~Key on Motor Commutator~~

18 Pole fields in 2 transformers

~~Putting pole transformer bolts~~

~~Turning commutator bolts for 2 transformers~~

21 Keying in 2 trans. commutators

22 Connecting Motor armature

23 Drilling for main shaft bearings

24 " " Reversing levers "

~~Set screw in shaft spring adjust~~

~~Clear for tube~~

~~Drill holes in frame to fasten~~

~~2 Car bottom~~

~~1 Car wheel tire~~

~~Fitting worm & wheel tire~~

~~Fitting worm wheel tire (2)~~

30 2 pickers up

31 Fit up 2 Transformers
32 Extra motor armature
33 Extra transformer "
~~File on ball rings~~
~~Place brass wheel braces for~~
~~Steel brush brackets~~
36 Make 2 Steel brush line cleaner
to sketch
37 Two bars for side rail brushes
38 Two sets brushes for side rails

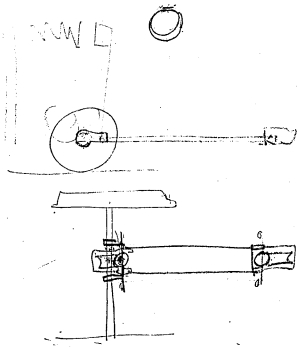
23 ½ oz of # 31 B.W.G. 0.010" s. silk cond. 0.013"
11.¾ - - - - on each limb.

1 # 32 B.W.G. wire 56 turns round.
splice each div on first layer

Wax moulds

25 Steel moulds for top ring

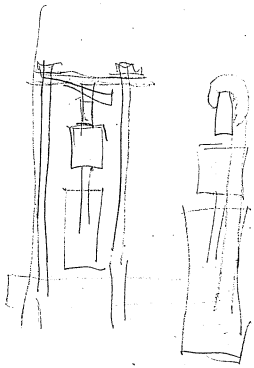
6 Steel " " phonen cylinder



Rock drill

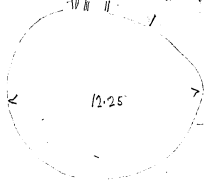
Drill & frame frame

Frame brass spool for sliding



107

1.027



1a = 182
2a = 132
3a = 82
ac = 102
H.P. = 232 = 0.93 a

21 070
21 28
52 88
114

12250
7600
26850
15350
12320
26850

2845
14
28 45
14 15
14 15
8 0
10 9 21
5 19

18
82
144
34
183

13 524

54
18
132 54

64 13
13
77

6 72
78 13
63

13
6
78

36
26
72
98

26 78
132 84

26
84
114

334
14 56
19
75

4' 59
21 10

114
13
72
85

77 86
72 64
169 150

12
23
46
276
322
69
391

+23
64
187

23
15
115
345
14

7930
14
224

23
14
92
322
69
391

63

605 on 3 / 684 77
84
224

35

224
375
30.00
430
430
505.00

5572
25 65
3007
505
3512

684
375
3420
4788
2052
256500

Station	Length	Center distance	Yards	Angle	Ground profile	Alignment	Remarks
$A_3 B_3$	500'	250'	183	31 L	35		100
$B_3 C_3$	300	150'	65	11 L	8		100
$C_3 d_3$	300	250'	132	22 L	25		100
$d_3 B_2$	660	250	80	13 L	15		100
$B_2 C_2$	600'	330	94	16 L	25		100
$C_2 D_3$	300	250	65	11 L	12		100
$D_3 E_3$	300	175	91	15 L	12		100
$E_3 F_3$	560	275	77	13 L	15		100
$F_3 G_3$	320	100	32	5 L	3		100
$G_3 G_3$	300	50	4	1 L	3		100
$G_3 H_3$	300	300	63	11 L	15		100
$H_3 H_3$	660	300	50	8 L	12		100
$H_3 I_3$	530	375	114	19 L	30		100
$I_3 I_3$	550	125	42	7 L	5		100
$I_3 J_3$	450	250	85	14 L	15		100
$J_3 J_3$	380	200		L			100
$J_3 J_3$	500	200	98	16 L	15		100
$J_3 J_3$	500	225	114	19 L	20		100
$J_3 J_3$	450	150	32	5 L	3		100
$J_3 J_1$	525	125	16	3 L	3		100
	10370						

Section	Length	Center dist.	Lamps	amps	Cost per foot
A4 X	150	50	15	3	100 3
B4 A4	220	125	32	5	100 3
B4 C4 W	740	300	179 + 10	52	40
B4 C4 E	730	500	141	24	50
C4 D4 W	820	520	125	21	45
C4 D4 E	820	410	104	17	30
H4 E4	380	200	36	6	100 5
E4 F4 W	220	150	78	13	100 8
E4 F4 S	300	175	36	6	100 5
F4 G	300	150	117	20	100 12
J4 I4	380	75	34	6	100 3
I4 O	320	200	78	13	100 12
J4 L4	380				100
L4 O4	180				100
G4 A4	600	300	67	11	100 15
G4 G	900	650	75	13	100 35
C4 H4	540	150	7	1	100
G4 H4	900	600	128	22	100 55
N4 X	380	250	76	13	100 15
H4 J4	450	–			100
M4 L4	356	150	70	12	100 8
I4 N4	220				100
M4 O W	380	125	51	9	100 5
M4 O E	380	125	19	3	100 3

Section	Length	Center dist.	Lamps	amps	Cost per foot
K4 N4	800	275	114	19	100 20
K4 N4	200	–	–	–	100 –
N4 O W	250	100	17,15	60	100 25
N4 O E	250	30	91	15	100 3
	11,180				

Section	Length	Center disch.	Lamps	Amperes	Dia. of pipe
$A_5 O_5$ w	440	350	89	15	20
$A_5 J_5$	440	200	30	5	5
$A_5 D_5$ E	380	275	35	6	8
$A_5 B_5$ w	320	325	50	8	12
$D_5 J_5$ E	380	130	73	12	8
$B_5 C_5$ w	520	225	115	19	20
C_5 Ow	380	225	58	10	8
$C_5 O_E$	300	250	69+14	65	70
$B_5 B_5$	350	120	20	5	3
$E_5 B_5$ E	450	250	14	11	8
$E_5 H_5$ w	440	275	8	1	3
$E_5 J_5$ w	430	175	17	3	3
$E_5 J_5$ E	300	150	14	2	3
$J_5 \Phi_5$	200	150	232+12	35	55
$E_5 C_5$	400	350	20	3	5
	5960				

Section	Length	Center disch.	Lamps	Amperes	Dia. of pipe
$A_2 E$	975				
$A_2 K_2$ w	960	300	99	17	20
$A_2 B_2$ E	800	350	57	15	25
$H_2 A_2$	480	275	66	9	8
$H_2 C_2$ E	360	125	50	8	5
$H_2 C_2$ w	500	250	24	4	5
$H_2 E_2$ W	900	450	150	25	50
$B_2 E_2$ E	800	475	135	23	50
$H_2 J_2$	400	150	36	6	5
$B_2 E_2$	360	150	130	22	12
$E_2 D_2$	360				
$J_2 D_2$ w	860	300	146	24	30
$J_2 D_2$ E	700	300	70	12	15
$J_2 H_2$	580	250	105	18	20
$J_2 G_2$	280	125	66	11	5
$J_2 \Delta_2$	680	300	68	11	15
$J_2 \Theta_2$	280	125	36	6	3
$H_2 \Phi$	450	200	122	20	20
$H_2 L_2$	480	300	63	11	15
$H_2 L_2$	600	75	121	20	8
$H_2 \Phi$	450	225	150	25	25
$H_2 P_2$	350	200	47	8	8
$P_2 \Phi$	450	225	130	22	20
$P_2 Q_2$	550	350	104	18	30
	13530				

Section	Length	Rise	Tangent	Angle	Sound Block
	1330				
$X_2 M_2$ w	500	275	78	13	15
$Y_2 M_2$ e	520	175	50	8	8
$D_2 M_2$	400	200	54	9	8
$M_2 N_2$ w	800	300	67	11	15
$M_2 N_2$ e	650	275	54	9	12
$J_2 N_2$	480	125	8	1	3
$N_2 O_2$ w	480	350	52	9	15
$N_2 O_2$ e	450	200	36	9	8
$O_2 P$	450	250	113	19	20
$M_2 R_2$ n	330	200	18	3	3
$M_2 R_2$ s	320	50	18	3	3
$R_2 Q_2$ w	360	150	85	14	8
$R_2 Q_2$ e	500	250	72	12	12
$R_2 T_2$ n	500	275	36	6	8
$R_2 T_2$ s	350	200	13	2	3
$T_2 S$	600	450	83	14	25
$T_2 S$ n	850	425	67	11	20
$T_2 U_2$ w	730	375	75	13	20
$T_2 U_2$ e	730	375	62	10	15
$N_2 S_2$	350	100	18	3	3
$S_2 S$ w	430	250	88	15	15
$S_2 S$ e	430	160	132	22	15
$S_2 U_2$	350	75	49	8	3
$U_2 S$ s	530	225	65	11	12
$U_2 S$ n	230	100	36	6	3

25850
5960
11780
10370
53960 ft

48.

10920 25 38
1441 38 12
1004 58 917
2528
1431 3445
250 1447
153
140 419
125 80
125 60 577
17 18 17 07
11
346 17 08
5760
5

53960
4268 80
4268 40
4268 20
4268 00
4268

5960	906	26	250
25850	17 07	15	346
10420	19 41	630	140
25850	3445		577
47930	10920		14159
102740	18479	671	5472
1		2	13 1
103,740	18,481	684	5572

901
67

Total No. of feet of main	103740
" " " Lamps	18481
" " " Horsepower	228
" " " Amperes	3512

Amperes at feeder Points

B	45	R^2	92
O	14	U^2	109
G	169		
I	254	A^3	47
N	380	C^3	63
n	76	E^3	39
P	387	H^3	40
T	305	I^3	54
u	229	J^3	8
W	314	B^4	83
		D^4	49
		G^4	39
C'	51	C^4	53
E'	138	H^4	32
H'	18	I^4	41
J'	96	K^4	87
K'	93	B^5	108
R'	126	E^5	90
S'	38		
T'	111		
V'	91		
X'	333		
Y'	191		
B^2	54		
D^2	123		
J^2	78		
K^2	117		

25	12
30	15
35	18
40	20
50	25
75	25
100	35
150	40
200	50
300	75
80	25

Formulae for Feeders

distance × amperes ÷ 13.7 = feeder area

Acme Point, New Port, R. I.

Feeder.	Distance.	Amps.	amp.	cond. needed	cond. adopted
1	550	183	31	15	80
2	1900	192	32	50	80
3	3340	207	35	95	100
4	3200	190	32		
5	3150	125	21		
6	3850	250	42	130	120
7	2925	145	24	55	80
8	1450	196	33	40	80

Junction Box, Adams 445 = 120 cond.

4	450	190	32	80	80
5	400	125	21	55	80

Cost of Feeders

			Per mains
1	80	.752 per foot	413.60
2	80	.752 ...	1424.80
3	100	.80	2704.00
4	80	.752	338.40
5	80	.752	300.80
(445)	120	.864	2376.00
6	120	.864	3146.40
7	80	.752	2199.60
8	80	.752	1090.40
			$13998.80

Mains.

Section	Length	C. M.	Lamps	Amps.	Cond.
1-2	1350	660	117	20	7425
2-3	1480	975	204	34	18281
3-4	975	500	76	13	3375
4-5	825	340	75	13	3315
5-6	1200	775	110	18	8183
6-7	1000	525	115	19	5512
7-8	1425	775	131	22	11044
8-1	900	500	111	19	5250

In determining these, 3/4 of amperes were figured on, instead of full amount, then used .75 as constant, thus.

660 x 15 x .75 = 7425
Formula
3/4 amperes x distance x .75 = conductance

Main needed	Main adopted	Cost per foot	Cost per main
85	80	.732	1012.50
200	200	1.26	1864.80
40	40	.75	731.25
40	40	.75	618.75
90	120	.84	1032.00
60	80	.75	750.00
120	120	.84	1225.50
55	80	.75	675.00
			$7409.80

House service

Section	House Dist.	Lamps	Amperes.
1 - 2	1 special 80	75	13
	2 90	15	3
	3 60	12	2
	4 60	20	3
	5 60	25	4
	6 75	25	4
	7 90	25	4
2 - 3	1 special 230	50	8
	2 130	25	4
	3 175	25	4
	4 325	35	6
	5 230	12	2
	6 190	15	3
	7 175	25	4
	8 110	18	3
	9 175	25	4
	10 90	12	2
	11 90	12	2
3 - 4	1 special 340	40	7
	2 special 160	12	2
	3 special 150	12	2
	4 150	18	3
	5 250	18	3
	6 175	40	7

Board.	Main mersed	main adopted	Cost per foot	Cost per main
17680	190	200	1.26	$256.20
540	8	80	.75	60.50
240	3	80		45.00
360	5	80		45.00
480	5	80		45.00
600	8	80		56.25
720	8	80		60.50
3680	40	80		172.50
1040	12	80		97.50
1400	15	80		131.25
3900	45	80		237.75
920	12	80		172.50
1140	12	80		135.50
1400	15	80		131.25
660	8	80		82.50
1400	15	80		131.25
360	5	80		60.50
360	5	80		60.50
4760	50	80		253.00
640	8	80		120.00
600	8	80		112.50
900	10	80		112.50
1500	15	80		187.50
2450	25	80		131.25

House Service

Section	House	Dist.	Lamps	Amp.	Cond.	Main meter	Main adapter	Cost fixtures	Cost per main
4 - 5	1 special	5 60	75	13	3960	40	80	75	420.00
	2	75	75	13	1950	20	80		56.25
Junction Box	3 special	7 00	35	6	2400	90	100	80	560.00
5 - 6	1 special	3 00	75	13	7800	45	100		240.00
	2	90	25	4	720	8	80	75	60.50
	3	100	25	4	800	8	80		75.00
	4	175	35	6	2100	25	80		131.25
	5	100	25	4	800	8	80		75.25
6 - 7	1 special	25	75	13	18850	200	280	1.26	713.50
	2 special	550	25	4	4400	50	80	75	412.50
	3 special	250	25	4	2000	25	80		187.50
	4	325	25	4	2600	30	80		237.50
	5	110	40	7	1540	20	80		82.50
	6	350	25	4	2800	30	80		262.50
	7	125	25	4	1000	12	80		93.75
7 - 8	1 special	840	35	6	5040	55	80		620.00
	2	150	25	4	1200	12	80		112.50
	3	240	35	6	2880	30	80		220.00
	4	175	35	6	2100	25	80		131.25
	5	75	12	2	300	3	80		56.25
	6	75	12	2	300	3	80		56.25
	7	75	12	2	300	3	80		56.25
8 - 1	1 special	475	50	8	3800	85	100	80	320.00
					7600				

Section	House	Dist.	Lamps	Amperes	Cond.	Main needed	Main adopted	Cost per foot	Cost per main
8-1	2	100	25	4	800	8	80	.75	75.00
	3	100	25	4	800	8	80		75.00
	4	80	25	4	640	8	80		60.00
	5	125	12	2	500	5	80		93.75
	6	60	12	2	240	3	80		43.00
	7	125	12	2	500	5	80		93.75

Formulas for House service mains,

amperes × distance × 2 = conductance

P0 = 752
1200
1504.00

752
1504.400

752
2400
451200
1504
1755.200

3400
110
3400
3740.00

4100
120
P64 0
4100
3456.00
3542.400

P0
12000
P
962.00

1	=	902.40
2	=	1955.20
3	=	3542.40
(445)	=	3740.00

Lardo 1.94

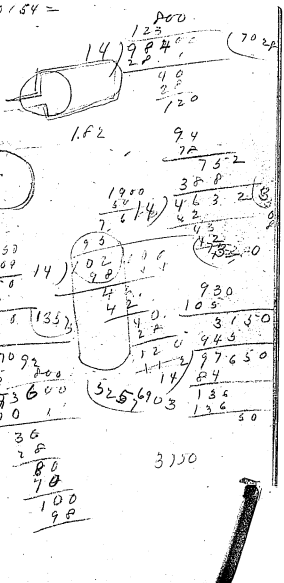
1st Lagoon 3.27

2 nd " 3.38

	Route	Length	Imp.	Bard.	meadow	
B 2	Jamaica Bassett	1900	54	7320	40	160
H 2	Marlandt Bassett	800	123	7025	75	150
J 2	Bassett	940	75	3308	35	70
K 2	Bassett Eastbrook Lotherton	930	105	6903	75	150
L 2	Bassett Maslem	800	92	5257	40	170
U 2	Alexandra Marlborough	1750	109	13575	150	300
			561			

57, 4-5

1900/54 =



Feeder	Grade	Length	Amps	Cond.	needed	adopted
a 3	11th St	1180	36	6068	65	
b 3	Lexington	1180	63	1620	15	
c 3	11th St	1220	39	6797	75	
d 3	10th St	730	40	4171	45	
f 3	Lexington	500	54	3857	40	
f 3	Lexington & 10th St	1360	8	10800	12	
		5160				
B [illegible]	[illegible] Palmetto	500	74	9235	100	
B [illegible]	Brooks St	730	33	9030	95	
B [illegible]	[illegible]	500	47	10933	120	
G 4	[illegible]	500	52	3785	40	
G 4, Cor. Hanover		920	39	5115	55	
H 4	Nolland	50	12	228	3	
K 4	Palmetto	775	87	9632	100	
J 4	Palmetto & Cor. Virginia	2400	41	14057	150	
		6175	400			
B 5	Reed St	200	70	1400	15	
E 5	Reed St & Fickle St	1000	90	12857	140	

~~4 feeders~~
4 cables in front feeders
3 " in feeders for Hampton.

$\frac{1180 \times 36}{7} = 6068$

$\frac{1180 \times 63}{7} = 10620$

$\frac{1220 \times 39}{7} = 6797$

$\frac{730 \times 40}{7} = 4171$

$\frac{500 \times 54}{7} = 3857$

$\frac{1360 \times 8}{7} = 1620$

$\frac{500 \times 74}{7} = 5425$

$\frac{500 \times 47}{7} = 3357$

$\frac{500 \times 52}{7} = 3785$

$\frac{920 \times 39}{7} = 5115$

$\frac{50 \times 12}{7} = 85$

$\frac{775 \times 87}{7} = 9632$

$\frac{2400 \times 41}{7} = 14057$

$\frac{200 \times 70}{7} = 1400$

$\frac{1000 \times 90}{7} = 12857$

Electric cooking experiments

B.P. 112 volts Nov. 17-1910

Wire	Back. Gal.	Time	Temperature
6"	.22	5'	no effect
	.25	5'	hardly percept. rise
	.28	5'	" "
	.315	5'	slightly warm
	.37	5'	" "
	.45	5'	warm
	.55	5'	slightly hot
	.73	5'	" "
	1.08	5'	hot
	1.12	5'	rather slightly red
	1.18	5'	light red.
	1.26	5'	bright red
7 amperes	1.34	5'	very bright red
14 volts	1.42	5'	correct temperature

.0025 ohm

6"	1.1	5'	slightly hot
	1.32	5'	hot
	1.8	5'	very hot
	1.86	5'	warm
	1.34	2'	very warm
	2.12	5'	light red
	2.38	5'	brighter red

$$0.195 \times .45 = .0877\,5$$

$$.195 \times .73 = .1425$$

$$1.42 \times 195 = 710$$
$$1276$$
$$142$$
$$.2769$$

Electro cautery experiments (cont.)

[illegible] .0025" March 15 1890

length wire [illegible] resistance Time Temperature

6" 2.65"

2.6

3.5 volts [illegible]

1" = .58

6 " 2.32

13 amp " 2 " 6.5

5 cells @ 0.02 = 2.15"

[illegible] = [illegible]

5×0.7 = 3.5 = 2.5

2 wire

Electro Cautery [illegible]

March 18

002 5" wire red hot only in the middle of length which was 2 3/4 inches.

at first bright red white length, but gradually cooled off.

about 12 amperes for Black gal.

Small wire, 6 inches long, heated to a dull light red with 1.2 on Black gal. after 5 min. cooled off to such an extent that no red was visible

5 in. small wire.

1.26 on Black gal.

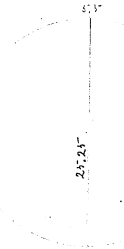
became red hot on completing circuit after 5 minutes dull red heat.

4 in small wire

2.8 volts diff of Potential between wire terminals, with 1.4 on Black

on making contact became bright red, would burn through wood. after 5 minutes there was still much difference in temperature.

in water. out of water.
2771.212 3961.912



On Tuesday a week thereafter

41	[illegible]	[illegible]
42	"	25 [illegible] "
42	"	[illegible]
40	"	75 "
3[illegible]	"	[illegible]
[illegible]	"	50
40	"	[illegible]
3[illegible]	"	[illegible]
3[illegible]	"	2 [illegible]
3 8 25	"	2 30
37	"	3 75
34	"	[illegible]
35	"	3 25
30	"	upfoward

36	300	At New [illegible]
36	[illegible]	[illegible]
32	"	at [illegible]
20	[illegible]	[illegible]
20	[illegible]	[illegible]
18	[illegible]	[illegible]
21	"	[illegible]
16	"	[illegible]
34	"	400 At [illegible]
34	"	375 " " "
36	"	350 " " "
35	"	325 " "
37	"	300
36	"	275
35	"	250
36	"	225

34 [illegible] at [illegible] trans. 175

35 " 125

35 " 125

36 " 100

37 " " " 75

37 [illegible]

36 " " 25

37 " " transformer

[illegible] maximum. At about 300 [illegible]
after increased to about 1200
variation between 1000 and 1500
current [illegible] transformer to high
[illegible] measured
Current at upper end of track to
high to be measured
no leakage between the rails.
current at bridge to high to
be measured

current at [illegible] P.S. to high
" at Rumford 72
" third transformer 70
" end of track cut [illegible] 60
no leakage.

Section	Length	C.	Lamps Amperes.	Cond.	Required
Feeder NE	3450		561	44307	475
B²	1625		54	10028	110
H²	675		123	9434	100
J²	660		78	5850	65
K²	1050		103	12528	140
R²	775		92	7227	80
O²	1750		109	21596	240
Feeder NW.	3800 + 375		240	20965	220
A³	1695 +		36	6852	75
G³	650 +		63	4866	55
E³	1700 +		39	7534	80
H³	835 +		40	3795	40
D³	+ 375		54		
J³	835 −		8	− 759	8
Feeder NW.	3425		240		
A³ } C³			75		
E³					

561
3450
2805
2164
1183
19275 45 0.0 (4435)
1740 x x x
1874
1740
1345
1305
40 0 0
39 95

1625
54
7000
8125
8.8) 88 25 0.0 (4430)
88 x x x
250
176
740

123
675
2025
1350
675
8.8) 8 30 25 0.0 (94.3)
792 x
3852
3552
305
264
410

660
28
4680
468
8.8) 5148 0.0 (58.50)
440 x x x
708
704
440
440
0

105
105
0
525 0

775
92
1550
6205
8.8) 6360 0.0 (72.27)
616 x x
700
176
640
176
640

1750
109
1505 0
1750
1505 0
(21596) (240)
8.8) 11900 5 0.0
1760 x 525 5 80
1760 440
88 350
52 792

1030
8.8) 11025 0.0 (125.28)
88 x x x
222
176
465
250
176
740

3860
240
152000
76

435) 91200.0 (209.65 8.8
870 x x
4200
3915
2850
2610
2400 8.8
2173

1760
34
15300
51

8.8) 6630000 (753.4
616 x x
470
440
300
264
360
352

6808.63
63
2040
4080

8.8) 42840.0 (4.8
352 x x
764
704
608
528
720

1675
36
10050
5025

8.8) 60300.0 (6852
528 x x
7500
7104
4600
4400
2000

835
40
8.8) 33400.0
264 x x
700
616
8400
7920
480

835
8

8.8) 6680.0 (757
616 x x
5200
4480
800

3425
240
137000
6850

430) 822000.0 (126
43.5 x x
3870
3470
3000
0

122 + 23% = x.
41 x = 23
x = 163

174
700

746) 34800 (46.6
2984 x
4960
4476
4840

= 20%

163) 32600 (43.7
746) 2984
2760
2238
5220
5222

= 25%

diff 8 2.9 HP

Page of B. [illegible] from extra [illegible]

Add Parts = 5%

~~B 2~~	~~1625~~	~~=~~	~~109 19~~	~~120~~
A 2	600	123	10390	110
J 2	660	19	6425	70
K 2	1050	147	15356 ~~14353~~	170
[illegible]	~~920~~	92	8915	95
	1730	109	23848	260

B 2				
A 2 } E 2	660	163	35860	420
B 2	975	54	10530	110
U 2	1075	123	26484	240

1625
54
6500
8125

109 19

1625
66
975

8) 103700 1750
675
1075

8) 151200
[illegible]

8) 1125000
140625

8) 190750
23 [illegible]

8) 71820
8975

3 tolls dis on double feeder 7 on funiculum
5 " " " single feeder 5 on funiculum

3) 107570
35860

163
660
9780
9780
107580

975
54
3900
4875
52650

5) 52650
10530

5) 132420
26484

Tenders for N.W. District financial feeding
Pilot Club Poole

Section	Length	Super.	Cond.	Rejects	
A3 } B3 C3	325	75	12188	130	
A3	975	36	5850	65	
B3	1025	39	6662	70	
B3	325	63	2559	80	
A3	575	40	2874	30	
I3	375	54	2542	30	
J3	120	8	1200	12	

main feeder	3450	feeders	240 cond.		
	length	amps	Cond	Rejects	
D3	375	54	2542	30	100
E3	450	8	450	5	100
A3 } B3 C3	1050	75	19688	220	250
F3 } G3 H3	750	103	15450	170	200
A3	1000	36	9000	100	100
B3	1025	39	7444	80	100
H3	575	40	7333	80	100
C3	325	63	6825	75	100
	555				

325
75
2/24375
12188

6/39990
6662

325
63
975
1950

6/35100
5850

8/20476
2559

8/22995
2874

8/20250
2542

8/96000
1200

163
20
3260

25
8

3450
240
13800
690
32.6 / 22800000 / 25400 / 19688
652000
1760
1630
1300
1304

1050
75
5250
7350
4/78750
19688

450
8
3600

750
103
5150
721
5/77250
15450

4) 36000
9000

325
63
975

1950
3) 20475
6825

1025
22
9225
2050
4) 21525
7444

573
40
3) 23000
7333

185

5350
200
300) 1070000 (3282.2
900
920
652
2680
2608
720
652
6P0

375
80
30000
400
50
32 0.00

357.97
8) 136000
4300

8) 140495
5062

989800

Feeder 5338 feet long - 200 amperes = 350

B 375 100 35 = 100 @ 300

E 400 90 50 = 100 @ 320

Main feeder 98,400
320
300

1500) 20072 (1336
5022
5210
6980 → 10518

20
23
8
52
598
900
1500

5960
37
4172
1788
220.52

900

621
38
49800
18675
23655.0
900) 20073 (2215
1953
1010
5000

400 × 80 = 32000

440 × 80 = 35200

600 × 80 = 48000

880 × 80 = 70400

720 × 80 = 57600

340 × 80 = 27200

450 × 80 = 36000

300 × 80 = 40000

500 × 80 = 40000

420 × 80 = 33600

450 × 80 = 36000

650 × 80 = 52000

1050 × 117 = 73500

1050

1050

122850 ÷ 8 = 15356

23 × 25 = 37

21

19

11

9 6

70°F = 35/9

70 : 21.1

~~7400~~

45.9734 × 1.00192

91946

4137606

459734

45973400

46061628918

1.0179) 46.640 (45.7

57440

~~1.03142) 46.0~~

April 1st 90

11 AM Resistance of coil by bridge

1000 to 100 = 47.3 Ohms

Temp: of bridge 22.5°

5 Ohms added to Spool side of balance;

7363 Ohms

23.5 Ohms

2.021 Ohms (Black)

Temp of H₂O 16.5° C.

4.6°C

7260.5

3630

0.388

46

2328

1552

178648

1.785%

46.46 × 1.01785

4646

61071.0

407160

61071.0

407160

47289310

Temp Bridge 21.9

15.5

6.4 × 0.03 = 192

1.00192 w

3630 ([illegible])
47.2893

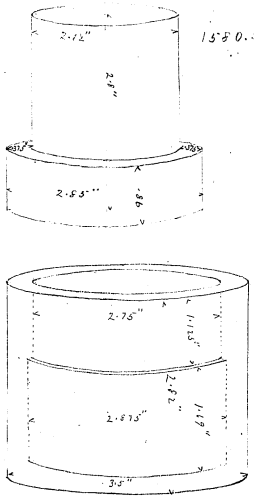
1.2276
47.[illegible]

2.021

1.2276
[illegible]
[illegible]
73656
36828
[illegible]

47.2893 | [illegible]
2001510
1169338

actual size



1580.5 grams

1219 grams

diameter when covered with oil paper, 2.13"

Winding space 1 29/32"

diameter of wire (bare) .0508"

" " " (including insulation) .0618"

diameter of fine wire (bare) .012"

" " " " (insulation) .0153

10.5 w added to #1 coil @ 23.[illegible]

#1 [illegible] 46.[illegible]

.57 w added

#2 - 46 w

T.B. 25.2°C

.450 w added

Rise of 9.7450 w thru heater

15.[illegible] added from the other coil

#1 by bridge 46.795

#2 " " 46.550 } 22.[illegible]

T.B. 26.6°C

loss: 0.088 w

#1 taller + rough

#2 shorter + smaller on bifeets

120.5 — 1 feb. 1φ

−125.5 — 285°C

+121.5

−124 — Zero shifting

+123 — slig. Cl₂

−123.7

+122

−123

4.5120 1000/min 0.118 } 4 off

Tool Steel 0.030 } Full

4.465 air 0.4 } 10 off

Wrought 0.04 } Full

4.522 0.113 } 7 off

Good 0.016 } Full

4.452 1000/min 0.079

~~1000/10~~

4.464 1000/min 0.023

0.023